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2.	Patent application number *(The Patent Office will fill in this part)*	30 JUL 2003 0317868.8
3.	Full name, address and postcode of the or of each applicant *(underline all surnames)* 08047819001 Patents ADP number *(if you know it)* If the applicant is a corporate body, give the country/state of its incorporation	**DISPERSE LIMITED** **European Centre** **Surrey Research Park** **40 Alan Turing Road** **Guildford,** **Surrey,** **GU2 7YF** **United Kingdom**
4.	Title of the invention	**BILIQUID FOAMS WITH A HIGH ALCOHOL CONTENT AND PRODUCTS FORMULATED THEREFROM**
5.	Name of your agent *(if you have one)* "Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)* Patents ADP number *(if you know it)*	**BOULT WADE TENNANT** **VERULAM GARDENS** **70 GRAY'S INN ROAD** **LONDON WC1X 8BT** **42001**

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BILIQUID FOAMS WITH A HIGH ALCOHOL CONTENT AND PRODUCTS FORMULATED THEREFROM

The present invention relates to biliquid foams with a high alcohol content and to products which are formulated therefrom.

Biliquid foams are known in the art in which small droplets of a non-polar liquid such as an oil are encapsulated in a surfactant-stabilized film of a hydrocarbon bonded liquid, such as water, and separated from one another by a thin film of the hydrogen bonded liquid. The water or other hydrogen bonded liquid thus forms the continuous phase in biliquid foam compositions.

US-A-4486333 to Sebba discloses a method for the preparation of biliquid foam compositions which may comprise the non-polar liquid in a total amount of about 60% to about 98% by volume, the hydrogen bonded liquid constituting the balance. The polar liquid may comprise a petroleum derivative, paraffin or a liquid halogenated hydrocarbon. The biliquid foam composition prepared comprising 96% by volume methanol and 4% by volume water had a limited stability of only several days.

Biliquid foams are disclosed in the following literature references by Sebba:

"Biliquid Foams", J. Colloid and Interface Science, 40 (1972) 468-474; and "The Behaviour of Minute Oil Droplets Encapsulated in a Water Film", Colloid Polymer Sciences, 257 (1979) 392-396.

WO 97/32559 discloses a stable dispersion comprising an oil-based biliquid foam and an aqueous gel which is suitable for use in cosmetics, pharmaceuticals and other industries. This patent specification does not describe the use of high levels of alcohols in the compositions.

US Patent No. 4999198 disclosed a biliquid foam (or polyaphron) having a continuous aqueous phase and a disperse phase in which a drug is carried in the disperse phase. This patent does not disclose the use of alcohol in the aqueous phase.

There is a need to generate aqueous products with high levels of alcohol, in particular in the cosmetic and personal care markets. This need is not, however, addressed by conventional emulsion science because of the instability of emulsions containing high levels of alcohol in the aqueous phase. There is also a need to generate topical oil-based products with a high level of alcohol, which increases skin permeability, but which products do not suffer from the disadvantage of the resulting skin dryness.

We have now found that high levels of alcohol can be incorporated into biliquid foams by formulating the compositions using particular selected surfactants. We have also found that these biliquid foams can be formulated with structuring agents, such as aqueous gels, to give compositions with a desired rheology.

Accordingly, the present invention provides a biliquid foam consisting of from 10% to 98% by weight of a non-polar liquid other than a fuel and from 2 to 87% by weight of a continuous phase polar liquid comprising a C_1 - C_4 alcohol, ethylene glycol or propylene glycol, or mixtures thereof, in an amount of at least 65% by weight, wherein the biliquid foam is stabilized with an amount of from 0.5% to 2% by weight based on the total formulation of a surfactant which is selected from castor oil/poly (alkylene glycol) adducts containing from 20 to 50 alkoxy groups, or hydrogenated castor oil/poly (alkylene glycol) adducts containing from 20 to 60 alkoxy groups, or mixtures thereof.

The polar liquid is preferably aqueous and comprises from 50% to 99% by weight of the C_1-C_4

alcohol, ethylene glycol or propylene glycol, or mixtures thereof. The preferred C_1-C_4 alcohol for use in the invention is ethanol.

The particular classes of surfactant used in the present invention have been selected for use because of their ability to assist in the preparation of the biliquid foam compositions and because they impart good stability upon the majority of the biliquid foam compositions of the present invention prepared using them. The castor oil/poly(alkylene glycol) adducts generally impart a stability of up to 45 days, whilst the hydrogenated castor oil/poly(alkylene glycol) adducts generally impart a good long term stability of from 30 to 90 days.

The preferred classes of surfactants for use in the present invention are hydrogenated castor oil/polyethylene glycol adducts containing from 25 to 60 ethoxy groups, more preferably 40 to 60 ethoxy groups or castor oil/polyethylene glycol adducts containing from 25 to 45 ethoxy groups.

It will be understood by those skilled in the art that the choice of surfactant will also depend upon the particular non-polar liquid and the particular polar liquid and the amount thereof which are used in the preparation of the biliquid foams.

The surfactant which is used in the present invention may be used in combination with an appropriate co-surfactant. Examples of co-surfactants which may be used are polyoxyethylene oleyl ethers and hydrogenated castor oil/polyethylene glycol (25) adduct.

The preferred amount of surfactant for use in the present invention is about 1% by weight based on the total formulation.

The biliquid foam compositions of the present invention may also contain other additives such as preservatives (for instance to prevent microbiological

spoilage). These additives may be included in the non-polar liquid or the continuous phase.

It will be understood that the inclusion of these additives will be at the levels and with the type of materials which are found to be effective and useful. Care needs to be taken in the choice and amount of these additives to prevent compromise to the other performance advantages of the present invention.

Methods of producing biliquid foams are described in US-A-4486333 involving the preliminary formation of a gas foam in order to provide a sufficiently large surface area on which the biliquid foam can subsequently be formed. It has been found that the prior formation of a gas foam is not required to manufacture a stable biliquid foam, provided that a suitable stirring mechanism is provided in the manufacturing vessel. An important aspect of the present invention is the ability to manufacture biliquid foams without the preliminary formation of gas foam, by the use of a tank incorporating a suitable stirring mechanism.

Such an apparatus comprises a tank provided with a stirrer in which the stirrer blade breaks the interface between the liquid and air. A delivery device is provided through which the oil phase (non-polar liquid), which will comprise the internal phase of the dispersion is delivered to the tank. The design of the delivery device is such that the rate of addition of the internal phase fluid can be controlled and varied during the production process. A feature of the production process is that the internal (oil) phase is added to the stirred aqueous phase slowly at first until sufficient droplets have been formed to constitute a large, additional surface area for the more rapid formation of new droplets. At this point, the rate of addition of the oil phase may be increased.

The production process consists of the following steps:

1. The addition of one or more chosen surfactants to one or other or both phases (as previously determined by experiment).
2. The charging of the aqueous phase into the bottom of a process vessel.
3. The incorporation of the stirrer into the vessel so that it stirs the surface of the aqueous phase.
4. Adjustment of the stirrer speed to a previously determined level.
5. The slow addition of the internal phase whilst continuing to stir at the prescribed speed.
6. The speeding up of the rate of addition of the oil phase once a prescribed amount (usually between 5% and 10% of the total amount to be added) has been added.

The stirring rate and the rate of addition of the oil phase are variables, the values of which depend upon the detailed design of the manufacturing plant (in particular, the ratio of tank diameter to impeller diameter), the physico-chemical properties of the oil phase and the nature and concentrations of the chosen surfactants. These can all be pre-determined by laboratory or pilot plant experiment.

It will be understood by those skilled in the art that other manufacturing methods may be used, as appropriate.

The high alcohol biliquid foams of the present invention may be stabilized by means of an aqueous gel and, accordingly, the present invention includes within its scope a stable dispersion which comprises from 1 to 80% by weight of a biliquid foam and from 20 to 99% by weight of an aqueous gel.

The aqueous gel will preferably be formed from a

colloidal polymer or gum suspended in water, at a concentration of from 0.05 to 20% by weight, more preferably from 0.2 to 1% by weight. Suitable polymers or gums are, for example, alginate gums or their salts, guar gum, locust bean gum, xanthan gum, gum acacia, gelatin, hydroxymethylcellulose or its hydroxyethylcellulose, hydroxypropylcellulose, carboxymethylcellulose or its salts, bentonites, magnesium aluminium silicates, "Carbomers" (salts of cross-linked polymers of acrylic acid), or glyceryl polymethacrylates or their dispersions in glycols, or any appropriate mixture of any of these polymers and gums. Preferred gelling agents are those which confer plastic behaviour on the aqueous phase, that is, under their influence, any shear stress applied to the product must attain a minimum yield value before any liquid flow takes place.

The stable dispersions of the present invention may be used to formulate pharmaceutical or cosmetic compositions, for example, pharmaceutical or cosmetic compositions for topical application. Examples of active ingredients which may be included in such compositions are acyclovir, beclometasone, benzoyl peroxide, benzydamine, betamethasone valerate, caffeine, calamine, cetrimide, chlortetracycline, clobetasol, clobetasone, clotrimazole, crotamiton, diclofenac, diethylamine salicylate, diflucortolone, dithranol, econazole, erythromycin, fluocinolone, fluocinonide, flucortolone, fluorouracil, fluticasone, fusidic acid, felbinac, ketoprofen, gentamicin, hydrocortisone, hydrocortisone acetate, ibuprofen, isotretinoin, lactic acid, lidocaine/lignocaine, lidocaine and chlorhexidine/lignocaine and chlorhexidine, macrogol, methyl salicylate, metronidazole, mexenone, miconazole, nystatin, piroxicam, potassium hydroxy-quinoline sulphate and benzoyl peroxide, retinoic acid and its derivatives,

salicylic acid, sodium fusidate, coal tar and salicylic acid, coal tar and zinc, tetracyclin, titanium, tretinoin, triamcinolone, tioconazole, triamcinolone, triclosan, urea, zinc, zinc and ichthammol, and mixtures thereof.

The drug concentration will vary, depending upon the drug used, from about 0.01% to 10%. Hence, the compositions of the present invention comprise a safe and effective amount of the active ingredient.

The stable dispersions of the present invention may therefore be used to formulate the following compositions for use in the pharmaceutical or cosmetics industry.

Topical Compositions

The alcohol which is preferably contained in the biliquid foams used in the present invention enhances the permeation through the skin of the active ingredient(s). The biliquid foam delivers oils to the skin and this helps to overcome skin dryness associated with topical compositions containing alcohol and to restore the barrier properties of the skin.

Topical applications may comprise the delivery of drugs, such as NSAIDS or anti-acne compositions, in a cream or gel preparation, or the delivery of drugs such as nicotine, estradiol, nitroglycerin, testosterone, scopolamine, etc., via transdermal drug delivery devices or in a cream or gel preparation. Another topical application comprises the delivery of cosmeceutical products, such as anti-cellulite creams formulated with an active ingredient, such as caffeine, to the skin. The active ingredient will have an enhanced performance due to the skin enhancer effect of the alcohol.

Hand Disinfectants

Hand disinfectants formulated using the stable suspensions of the present invention have bactericidal properties provided by the high levels of alcohol contained in the compositions. The combination in the same product of the alcohol and oils avoids the skin dryness which is a disadvantage of existing high alcohol disinfectant compositions.

The present invention will be further described with reference to the following Examples:

Biliquid Foam Preparation

A suitable vessel is charged with the aqueous phase of the biliquid foam. The oil phase was added at a constant rate with stirring, using a sweep stirrer or an orbital mixer. After completion of the oil addition, the stirring was continued until the size of the oil droplets became stable or reached a desired size.

Stable Dispersion Preparation

In a separate vessel the aqueous gel phase components were combined to produce an aqueous gel. The biliquid foam was combined with the aqueous gel under low shear stirring until a homogenous product was produced.

EXAMPLE 1

	% (w/w)
Mineral Oil	90.0
Hydrogenated Castor Oil/ Polyoxyethylene Glycol (25) adduct	1.0
Ethanol	7.0
Water	2.0

Ethanol % of aqueous phase = ~78%
Surfactant % = 1
Stability - > 6 months

EXAMPLE 2

	% (w/w)
Isopropyl Isostearate (IPIS)	34.67
Isoeicosane (Permethyl 102a)	43.86
Isoctahexacontane (Permethyl 104a)	10.97
Hydrogenated Castor Oil/ Polyoxyethylene Glycol(25) adduct	0.50
Water	2.60
Ethanol	7.00
Polyoxyethylene(20)Oleyl Ether(Oleth20)	0.40

Ethanol % of aqueous phase = ~73%
Surfactant % = 0.9
Stability - > 6 months

EXAMPLE 3

	% (w/w
Dimethicone Polydimethylsiloxane (DOW Corning 200/350cs)	8.06
Dimethicone Polydimethylsiloxane (DOW Corning 200/5cs)	32.34
Dimethicone Polydimethylsiloxane (DOW Corning 200/20cs)	24.30
Dimethicone Polydimethylsiloxane (DOW Corning 200/30,000cs)	24.30
Castor Oil/Polyoxyethylene Glycol(25) adduct	0.50
Castor Oil/Polyoxyethylene Glycol(15) adduct	0.50
Water	2.50
Ethanol	7.50

Ethanol % of aqueous phase = 75%
Surfactant % = 1
Stability - 5 months

EXAMPLE 4

	% w/w)
Octamethylcyclopentasiloxane and organopolysiloxane (Gransil GCM)	48.6
Dimethicone and organopolysiloxane (Gransil TMG)	22.5
Dimethicone Polydimethylsiloxane (DOW Corning 200/50cs)	0.9
Cetearyl isonoanoate	9.0
Isopar K	9.0
Ethanol	7.0
Water	2.0
Hydrogenated castor oil/ Polyoxyethylene Glycol(25) adduct	1.0

Ethanol % of aqueous phase = ~ 78%
Surfactant % = 1.0
Stability - 5 months

EXAMPLE 5

	% w/w
Isopropyl isostearate (IPIS)	18.56
Isoeicosane (Permethyl 102a)	23.76
Isooctahexacontane (Permethyl 104a)	5.94
Octamethylcyclotetra-siloxane and dimethiconol (Dow Corning 1401)	11.14
Decamethylcyclopenta-siloxane (Dow Corning 245)	11.14
Dimethicone Polydimethylsiloxane (DOW Corning 200/100cs)	18.56
Hydrogenated castor oil/ Polyoxyethylene Glycol(25) adduct	0.50
Castor Oil/Polyoxyethylene Glycol(25) adduct	0.50
Ethanol	7.50
Water	2.50

- Ethanol % of aqueous phase = 75%
- Surfactant % = 1.0
- Stability - 5 months

EXAMPLE 6

	% (w/w)
Cetearyl isonoanoate	19.230
Isoeicosane (Permethyl 102a)	23.560
Octamethylcyclotetra-siloxane (Dow Corning 1401)	11.050
Decamethylcyclopenta-siloxane (Dow Corning 245)	11.050
Isooctahexacontane (Permethyl 104a)	5.890
Dimethicone Polydimethylsiloxane (DOW Corning 200/100cs)	19.220
Ethanol	7.000
Water	2.000
Hydrogenated Castor Oil/ Polyoxyethylene Glycol(25) adduct	0.625
Castor Oil/Polyoxyethylene Glycol(25) adduct	0.375

Ethanol % of aqueous phase = 78%
Surfactant % = 1.0
Stability - 1 month

EXAMPLE 7

	% (w/w)
Isopropoyl isostearate (IPIS)	90.0
Hydrogenated castor Oil/ Polyoxyethylene Glycol(60) adduct	1.0
Ethanol	7.5
Water	1.5

Ethanol % of aqueous phase = 83%
Surfactant % = 1
Stability - 6 months

EXAMPLE 8

	% (w/w)
Dimethicone Polydimethyl-siloxane (Dow Corning 200/350)	8.06
Dimethicone Polydimethyl-siloxane (Dow Corning 200/5)	32.34
Dimethicone Polydimethyl-siloxane (Dow Corning 200/20)	24.3
Dimethicone Polydimethyl-siloxane (Dow Corning 200/30000)	24.3
Hydrogenated castor oil/Polyoxyethylene Glycol (60) adduct	1.0
Ethanol	8.5
Water	1.5

Ethanol % of aqueous phase = 85%
Surfactant % = 1
Stability - 6 months

EXAMPLES 9 TO 12

Gelled Formulations

Example 9 to 12 show that there is a wide range of polymers, which can be used to gel the biliquid foams. These polymer systems can be prepared at different concentrations of ethanol. Hence, the concentration of ethanol in the final formulations can also vary. All polymers were dispersed in a water/ethanol mixture using a high-shear rotorstator mixer (Silverson) and neutralizers were added as appropriate, to form polymer gels. The biliquid foams were prepared as discussed above. All ingredients were mixed together at room temperature.

EXAMPLE 9

	% (w/w)
Klucel HF	0.300
Lubrajel DV	15.000
Ethanol	50.570
Water	23.300
Dimethicone Pllydimethylsiloxane (DOW Corning 200/350cs)	0.400
Dimethicone Polydimethylsiloxane (DOW Corning 200/5cs)	1.780
Dimethicone Polydimethylsiloxane (DOW Corning 200/20cs)	1.340
Dimethicone PolydimethylsiloxaneA\ (DOW Corning 200/300,000cs)	1.340
Isopropyl Isostearate (IPIS)	2.266
Isoeicosane (Permethyl 102a)	2.850
Isootahexacontane (Permethyl 104a)	0.710
Hydrogenated Castor Oil/ Polyoxyethylene Glycol (25) adduct	0.032
Castor Oil/Polyoxyethylene Glycol(25) adduct	0.059
Castor Oil/Polyoxyethylene Glycol(15) adduct	0.027
Polyoxyethylene(20)Oleyl Ether (Oleth-20)	0.026

EXAMPLE 10

	% w/w
Carbomer 980 TEA	0.60
Ethanol	50.91
Isopropyl Isostearate (IPIS)	3.12
Isoeicosane (Permethyl 102a)	4.00
Isoctahexacontane (Permethyl 104a)	1.00
Octamethylcyclotetra-siloxane (DOW Corning 1401)	0.24
Decamethylcyclopenta-siloxane (DOW Corning 245)	3.50
Dimethicone Polydimethylsiloxane (DOW Corning 200/100cs)	3.12
Hydrogenated Castor Oil/ Polyoxyethylene Glycol(25) adduct	0.08
Castor Oil/Polyoxyethylene Glycol(25) adduct	0.08
Water	33.35

EXAMPLE 11

	% w/w
Carbomer 980 TEA	0.45
Hydroxyethylcellulose	0.30
Ethanol	51.10
Mineral Oil	27.00
Hydrogenated Castor Oil/ Polyoxyethylene Glycol(25) adduct	0.30
Water	20.85

EXAMPLE 12

	% w/w
Biliquid foam of Example 6	16.68
Carbomer 980 TEA	1.20
Sepigel	0.50
Ethanol	57.16
Water	24.46

Drug Formulations

Examples 13 and 14 were prepared from biliquid foam shown in Example 4. The actives were in both cases formulated in the gel phase. The Carbomer was dispersed in the water/ethanol mixture using a high-shear rotorstator mixer (Silverson). The drug was then added to the above mixture once the Carbomer was fully dispersed and an aqueous solution of 20% triethylamine (TEA) was added until a clear viscous gel at pH 7 was obtained. The biliquid foam (Example 4) was mixed with the polymer gel at room temperature until a semi viscous white gel was obtained.

EXAMPLE 13

	% (w/w)
Ibuprofen	2.10
Dimethicone Polydimethylsiloxane (DOW Corning 200/50cs)	0.27
Cetearyl isononanoate	2.70
Isopar K	2.70
Octamethylcyclopentasiloxane and organopolysiloxane (Gransil GCM)	14.58
Dimethicone and organopolysiloxane (Gransil DMG)	6.75
Hydrogenated Castor Oil/ Polyoxyethylene Glycol(25) adduct	0.30
Carbomer ETD 2020	0.70
Ethanol	35.60
Water	34.30

EXAMPLE 14

	%(w/w)
Caffeine	3.080
Butylene glycol	2.800
Carbomer	0.154
Natrasol 250 HHR	0.238
Octamethylcyclopentasiloxane and organopolysiloxane (Gransil GCM)	14.580
Dimethicone and organopolysiloxane (Gransil DMG)	6.750
Na Hyaluronate (1%)	2.800
Kathon CG (0.4%)	2.800
Dimethicone Polydimethylsiloxne (DOW Corning 200/50cs)	0.270
Cetyl isononanoate	2.700
Isopar K	2.700
Hydrogenated Castor Oil/ Polyoxyethylene Glycol(25) adduct	0.300
Water	30.414
Ethanol	30.414

Footnote to the Examples

Isopar K-C_{13}-C_{15} Isoparaffin
Klucel HF - Hydroxypropyl cellulose
Lubragel DV - Polymethacrylate propylene glycol
Sepigel - Poly acrylamid/C_{13}-C_{14} isoparaffin laureth-7
Natrosol 250HHR - Hydroxyethyl cellulose
Kathon CG - Methylchloroisothiozolanone and methylisothiazolinone

WE CLAIM:

1. A biliquid foam consisting of from 10% to 98% by weight of a non-polar liquid other than a fuel and from 2 to 87% by weight of a continuous phase polar liquid comprising a C_1-C_4 alcohol, ethylene glycol or propylene glycol, or mixtures thereof, in an amount of at least 65% by weight, wherein the biliquid foam is stabilized with an amount of from 0.5% to 2% by weight based on the total formulation of a surfactant which is selected from castor oil/poly(alkylene glycol) adducts containing from 20 to 50 alkoxy groups, or hydrogenated castor oil/poly(alkylene glycol) adducts containing from 20 to 60 alkoxy groups, or mixtures thereof.

2. A biliquid foam as claimed in claim 1 wherein the amount of surfactant is about 1% by weight based on the total formulation.

3. A biliquid foam as claimed in claim 1 or claim 2 wherein the surfactant comprises a hydrogenated castor oil/polyethylene glycol adduct containing from 40 to 60 ethoxy groups.

4. A biliquid foam as claimed in claim 1 or claim 2 wherein the surfactant comprises a castor oil/poly(alkylene glycol) adduct containing 25 to 45 ethoxy groups.

5. A biliquid foam as claimed in any one of the preceding claims wherein the polar liquid is aqueous and comprises from 70% to 99% by weight of the C_1-C_4 alcohol, ethylene glycol or propylene glycol, or mixtures thereof.

6. A biliquid foam as claimed in claim 1 or claim 2 wherein the non-polar liquid comprises a mineral oil, a siloxane, an emollient ester, a glyceride, a lanolin oil, a natural oil, oleyl alcohol, isoeicosane or isooctahexacontane, or mixtures thereof.

7. A biliquid foam as claimed in claim 6 wherein the siloxane comprises dimethicone, cyclomethicone, dimethiconol, dimethicone copolyol, octamethylcyclotetrasiloxane, octamethylcyclopentasiloxane, decamethylcyclopentasiloxane, or mixtures thereof.

8. A biliquid foam as claimed in claim 8 wherein the emollient ester is isopropyl isostearate, lanolate, myristate or palmitate, or octyl palmitate, or mixtures thereof.

9. A stable dispersion which comprises from 1 to 80% by weight of a biliquid foam as claimed in any one of the preceding claims and from 99 to 20% by weight of an aqueous gel.

10. A stable dispersion as claimed in claim 9 wherein the aqueous gel comprises from 50 to 99% by weight thereof.

11. A stable dispersion as claimed in claim 9 wherein the aqueous gel comprises a colloidal polymer or gum suspended in water.

12. A stable dispersion as claimed in any one of claims 9 to 11 which includes therein at least one pharmaceutical or cosmetic compound therein.

13. A pharmaceutical composition which comprises a

stable dispersion as claimed in claim 12.

14. A pharmaceutical composition as claimed in claim 13 which is in a topical form for application to the skin and which contains a non-steroidal anti-flammatory drug, an anti-acne compound, anti-viral or anti bacterial compound.

15. A pharmaceutical composition as claimed in claim 14 which is in the form of a transdermal delivery device or in a cream or gel preparation and which contains nicotine, estradiol, nitroglycerin, testosterone or scopolamine as the active ingredient.

16. A cosmetic composition which comprises a stable dispersion as claimed in claim 12.

17. A cosmetic composition as claimed in claim 16 which is an anti-cellulite cream or an aftershave lotion.

18. A disinfectant composition which comprises a stable dispersion as claimed in claim 12.